Available online at www.sciencedirect.com

ScienceDirect

Energy Procedia 96 (2016) 94 – 99

Energy Procedia

SBE16 Tallinn and Helsinki Conference; Build Green and Renovate Deep, 5-7 October 2016, Tallinn and Helsinki

Key criteria across existing sustainable building rating tools

Maija Krizmane[a,*], Sandra Slihte[a], Anatolijs Borodinecs[a]

[a]*Riga Technical University, Kalku iela 1, Riga, LV-1658, Latvia*

Abstract

First international definition of sustainable development was published in 1987 within the Report of the World Commission on Environment and Development: ''Our Common Future'' that is more widely known as ''Brundtland Report''. The definition states that Sustainable development is the kind of development that meets the needs of the present without compromising the ability of future generations to meet their own needs. This definition serves a key element for many sectors that consider sustainability.

When it comes to sustainable building principles and building principles in general the definition is rather complex. The 3 key considerations from an architecture theory are aesthetics (technologies and shape of buildings), function (current function and possibility to adapt to future needs) and construction (materials used). Sustainability however focuses on 3 main areas - ecology, economics and society needs.

In order to successfully address all of these elements, certain systems and tools are needed to harmonize the process – building codes, standards, certification systems. Construction of building is a complex process that requires an integrated approach at all stages of the project in order to successfully meet the intention. When it comes to sustainable building in particular, various certification tools are in place to help address different aspects – environmental protection, economy over building lifecycle and social aspects, for example, accessibility, functionality and health.

This paper sets out an overview of the key focus of most commonly known international certification systems. These systems are compared on a basis of importance of ecology, economy, social, energy, health and comfort, functionality, technical, design and integrated approach aspects. This analysis of different priorities among these systems and adaptability potential to Baltic market will serve as a basis for further research in potential to develop a certification system for local market, taking into account the local circumstances.

The goal for the development of a local certification system is to create tool with straight forward criteria that can be easily understood by consumers (developers, investors, future owners and tenants, state and local government procurers) and can be implemented by specialists of building sector (architects, designers, project managers, builders).

Peer-review under responsibility of the organizing committee of the SBE16 Tallinn and Helsinki Conference.

Keywords: green building, rating tools, certification systems, LEED, BREEAM, Living Building Challenge, Green Homes

* Corresponding author. Tel.: +37126227672

E-mail address: maija.krizmane@gmail.com

Peer-review under responsibility of the organizing committee of the SBE16 Tallinn and Helsinki Conference.

doi:10.1016/j.egypro.2016.09.107

1. Introduction

Sustainability in buildings is an urgent topic in construction and environmental protection area both locally, with in the EU and globally. The recent signing of the Paris Agreement under the United Nations Framework on Climate Change Convention enshrines that global action is needed in order to fight adverse effects of climate change. Buildings account for 6.4% of global emissions directly and 12% indirectly (considering their energy consumption) as of data in 2010 [1]. The definition of sustainable development states that it is the kind of development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Therefore, development of sustainable buildings and enhancing the sustainability principles across existing building stock clearly benefits not only the fight against climate change in terms of carbon emissions but also contributes to the safety and well-being of humans.

Not only is sustainable building contributing to the carbon emission reduction, but also it enables other positive developments within society and economy. Humans spend more and more of their time indoors, therefore the adequate indoor environmental quality is crucial for our health. Sustainable buildings are designed in a way that helps to avoid ”sick building syndrome” and therefore improving health and productivity of buildings’ occupants. Additionally, enhanced energy efficiency, that is major element of sustainable building, allows savings for buildings’ occupants and hence poverty reduction. Sustainable building rating tools serve as an opportunity and an instrument in order to implement most ambitious national goals whilst also contributing to the overarching global goals.

In order to develop a truly sustainable building, complex measures need to be applied in all development stages in terms of aesthetics (technologies and shape of buildings), function (current function and possibility to adapt to future needs) and construction (materials used). In order to successfully implement these measures building codes, standards, certification systems are used.

The international rating tools, for example, LEED, BREEAM, Green Homes, Passive House standard, Nearly Zero Energy Buildings standard and others have shown a huge impact on the construction industry and identified the business case for sustainable buildings. Therefore, any applications of measuring sustainability on a national level, need to be developed by assessing the experience of internationally stable and well developed system, and progress over times must be considered. [2]

This paper seeks to identify the best practices and main principles for assessing sustainable buildings in Latvia and Baltics by looking at different international practices and local circumstances. The goal for further research is to develop a reliable, measurable, verifiable system that allows evaluating the existing stock and potential projects in terms of economic viability, which can only be done by looking at short and long terms benefits over the life cycle of buildings.

2. Overview of existing practices across different building rating tools

The ecology, economy, social, energy, health and comfort, functionality, technical, design and integrated approach aspects are evaluated in most of the international rating tools. The main focus varies in each system, however there are a set of common principles in every certification system.

2.1. Key units

When looking at the comparability of different types of buildings with different function, age and purpose, different approaches need to be used. However, in order to be able to compare buildings not only within a specific category or functionality, but also across different ones, united metric needs to be used.

Energy efficiency evaluation needs a very specific approach in order to comprehensively evaluate it and compare different buildings. The Energy Efficiency Certificates commonly used within the EU measure energy efficiency in kW/m^2 and assigns a specific rating based on that, which could seem a rather straight forward approach. However, it only allows comparability of buildings of different size. However different functions of buildings have different energy demand. For example, a warehouse building will have a significantly lower energy demand, than an efficient office building.

Some of the solutions for measuring energy efficiency in a more sophisticated manner can be found in LEED certification system and BREEAM system. LEED looks at costs of energy used, which not only awards a building for reducing its demand, but also for supplying energy in a cost-efficient manner. Key unit in BREEAM however is CO_2 emission reduction. This allows BREEAM to analyses the impact of buildings on the environment and climate change.

These measures and metrics of energy use for allow practical, but limited performance evaluation. However, in order to truly measure green in terms of energy efficiency and its impact on productivity and well-being, new units can be used. Acoustic, thermal, visual comfort are measures that impact our everyday lives and contribute indirectly to the economic benefits of green buildings [2].

In terms of other categories beyond energy efficiency, the approaches vary. For example, the sustainability of materials is evaluated both through the embodied CO2 as well as through different third party certifications. Often these certifications are specific for specific types of materials and many times also country specific, which contributes to the level of complexity in order to apply EU-wide approaches.

Overall, the key metrics in building rating tools aim to show the measurable added value and often ”business case”. When it comes to investments in sustainable development, verifiable benefit evaluation is needed for risk assessment that comes with the added up-front premium to the investments for implementing sustainable practices. If comparable and trusted, these benefits are applicable not only to investors, but also to the stakeholders of building construction process and later on sales of the building and building users throughout the building lifecycle.

The main benefits of building users over buildings' life-cycle are savings on water, heating and electricity bills, healthy indoor environments that ensure higher productivity and comfort. Building operators and owners are also benefiting from lower utility bills, lower maintenance costs of systems. Additionally, comfortable conditions ensure much better rental rates and higher occupancy. Developers and construction companies can assure a competitive project in terms of sustainability and environmental responsibility as well as quality. Common benefits of all stakeholders as well as society in general are reduced impact on environment - carbon emission reduction, reduced landfill and water pollution, protection of natural habitat and biodiversity. Those involved in the development of a sustainable construction project and those occupying the space afterwards can gain verified recognition for their efforts to protect the environment.

2.2. Overarching goals

The goals of certification systems can vary from country to country, climate zone from climate zone and even from region to region within a country, for example, different states with in the U.S. will have different standards and therefore different approaches in terms of recognizing leadership. However, some goals are common across all the systems not depending on the location, or local conditions.

Sustainable and green rating tools aim to reduce energy consumption and increase resource efficiency in buildings, minimize environmental pollution, encourage implementation of innovative solutions and technologies for the construction and operation of buildings.

2.3. Basic principles

Even though the specific features and even overall approaches of different building rating systems vary as described above, there are a set of basic principles that are common across all systems. These principles ensure the integrity of such systems as well as fit for purpose.

Building certification systems are voluntary tools for market to identify and award leadership in sustainable practices. Once the tools are stable in the market, there is a possibility to implement some of the principles within the legislation. In this case, the use of voluntary systems becomes obligatory because governments have recognized the positive impact and contribution to the overarching goals and defined previously ambitious practices as standard for the future. For example, looking at the federal agencies in the U.S., the U.S. State department committed to using LEED on the construction of number of embassies worldwide. In this way, not only is LEED contributing to meeting the sustainability goals nationally and saves public money over the life-cycle of these buildings, but also spreads the leadership globally. Currently, there are 35 LEED certified facilities within its overseas portfolio. Seventeen of the certifications were the first LEED certifications in the country, which is also the case for U.S. Embassy in Latvia. The

average modeled energy cost reduction is 27% and that is to be achieved through implementing solar power, solar shading, solar hot water, occupancy and daylight sensors, LED lighting, highly efficient HVAC strategies, highly reflective roofing materials that reduce the absorption of solar heat, electric traction elevators, and other energy conservation strategies [3].

Certifications are carried out through independent third party organizations. In order to assure quality objectives are set and implemented, followed by monitoring process and consultations on improvements, when setting updated objectives [4, 5].

In order to ensure adherence of different sustainability principles, minimum results need to be achieved across all categories. Depending in the system categories can be energy specific, materials, comfort, ecology, site management and others as described below. This helps avoiding a single focus in implementing green practices. For example, a well-insulated building might show great results in terms of energy efficiency, but only with adequate ventilation systems and healthy materials will it also ensure indoor environmental quality. Sustainability is a complex principle, therefore the solutions need to be carefully considered and implemented.

Certification systems can be used across different building categories – new build, existing buildings, even neighborhood developments and parts of development, for example, only interior design solutions. Buildings with specific functions, often have specific needs and therefore their certification systems have specific criteria. Healthcare facilities are an example of a very specific energy supply safety needs and specific consumption, as well as many other functional specifics, therefore the sustainable design of such facilities as well as evaluation for certification needs to be specific.

3. Considerations for national rating system development – Latvia's example

3.1. Legislative developments

The current legislative developments in Latvia show some potential for implementing sustainability principles in everyday practices within the construction sector. Main construction market in Latvia is public buildings and the energy efficiency improvements is of course a crucial topic based on the requirements of the EU law. The Directive on Energy Efficiency states that each Member State shall ensure that, as from 1 January 2014, 3 % of the total floor area of heated and/or cooled buildings owned and occupied by its central government is renovated each year to meet at least the minimum energy performance requirements that it has set in application of on Directive on Energy Performance of Buildings [6, 7].

The procurement of construction and renovation of public buildings is regulated by Public Procurement Law and also by Green Public Procurement promotion plan of Latvian Republic. Both of these regulations are in and updating phase in first half of 2016. Key challenges for implementing sustainability principles with these regulations, is to provide measurable and verifiable criteria for assessing sustainability to complement the criteria or "lowest price". The draft Green Public Procurement Guidance document for Office Buildings, developed by the Joint Research center sets out a set of criteria for green public procurements. The overarching principles are choosing best value for money and assessing the life cycle costs. The specific criteria considered are – energy consumption, lighting, building management systems, use of low energy or zero CO2 emissions energy sources, maintenance, resource efficiency (life cycle costs of main components of a building, use of recycled materials, responsible forestry for production of wood components, waste recycling), water consumption, thermal comfort, daylight, air quality [8].

3.2. Applications of international rating tools

There are few applications of international rating tools within Latvian construction sector. However, the first experiences of LEED existing building certification, BREEAM existing building and new building certification in the commercial sector have pointed out some challenges both from a legislation point of view and from the competency of the construction companies.

The skills and capacities in order to plan, design, build and operate sustainable buildings need to be constantly developed and improved. Encouraging applications of international assessment schemes versus nationally developed instruments, skill set needs to be wide and more general, then in case of a leading national tool, that is very specific.

International certification systems are advanced and constantly improved over time, raising the ambition. However, national rating system could be more flexible in terms of developments within local market. Additionally, developing a national rating system would allow less complexity, both in terms of the structure of the system, as well as certification procedure and therefore cost.

3.3. Defining national priorities

In order to set the national priorities, long and short term goals, a consultative approach needs to be taken. This has been done previously when adopting the BREEAM system. A multi-stakeholder dialogue was held in order to define a set of criteria that fit best for the needs of Latvian construction market. As a result, a criteria appendix was developed to complement BREEAM Europe Commercial Assessment manual of 2009 [9].

At this point, looking at a potential for new tool, current priorities need to be defined. The umbrella principle is environmental sustainability. However, in terms of national priorities of Latvia, sustainable buildings can contribute to other important needs. These include but are not limited to the energy independency and safety of supply, construction and design quality, durability of construction, resilience, including, resilience under the adverse effect of climate change, poverty reduction.

It is crucial to consider these priorities as long term goals when developing certification tools.

4. Hypothesis for further development

The development of a nationally used tool needs to be in line with political movements within the country as well as global developments. Various stakeholder groups need to be involved in the process of defining long term goals and specific stakeholder groups need to ensure that short term goals are contribute to meeting those whilst also allowing short term benefits. Continuous pilot testing, review and improvement is crucial to ensure that the most innovative approaches strive the market towards sustainable development.

5. Further research – next steps

In order to develop more detailed methodology to apply sustainable building rating tool approaches in the market to raise the quality of construction and mitigate the inefficient use of resources, firstly, research needs to be done on the existing cases of certified buildings and provide case study database, including lessons learned. Long term goals and short term commitments need to be set out in terms of applying sustainability criteria. The potential of enshrining the principles of sustainable building assessment principles within public procurement and green public procurement processes need to be explored. The main goal for applying these principles within public procurements is to allow measurable and verifiable formula for procuring economically viable construction instead of applying ”lowest price” principle. The proposed methodology needs to be then directed towards a multi-stakeholder dialogue.

6. Conclusions

Sustainable buildings contribute to meeting global goals in terms of climate change and human rights, as well as national and local goals of poverty reduction, job creation, economy growth, energy security, public health and others.

There are several major indicators that can be applied for evaluation of buildings’ performance. Innovative way and at the same time complex way is to measure green by assessing the human comfort and performance. Additionally, costs, and CO2 emissions can be used as performance metrics.

Green buildings show significant benefits over their lifecycle, and building certification systems ensure that these benefits are presented to the stakeholders (developers, owners, construction companies, investors, building users) involved in a straight forward, comparable manner.

All certification systems are aiming to award buildings that ensure environmental protection, reduce energy consumption, encourage resource efficiency and strive for ambition and innovation. Specific principles then can be focused on national priorities and local circumstances.

The current developments in Latvia show potential not only of implementing voluntary rating tools to provide quality assurance, but also for including sustainability principles within the legislation framework. Comprehensive and continuous stakeholder and expert dialogue is needed in order to pursue this.

International certification tools currently have been applied on few buildings in Latvia. The experiences show the challenges and necessary improvements, including also the difficulties in applying complex systems within local market. These lessons learned need to be further analyzed when considering national rating system.

In order to set out a tool that is politically supported and applicable, local priorities need to be considered and enshrined within assessment principles. The priorities for potentially new national rating system need to be set, taking into consideration both global and EU ambitions, as well as national setting. Currently, building safety, energy supply independency and energy efficiency are crucial topics that need urgent attention and specific focus. Additionally, the use local materials can be further developed and encourages.

Transparency and dialogue are key elements in order to keep the sustainable building system current and up to date. Further research needs to be done, in order to identify the lessons learned from previous experiences on sustainable building not only to seek for best ambitious practices to strive the market, but also to assess the faults in systems and within the sector, that interfere with implementation of sustainable construction principles across the market.

References

[1] IPCC, 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp., p. 47

[2] Christopher R. Pyke, Maija Krizmane. Measures of Energy and Human Performance for Residential and Commercial Buildings, Proceedings of the Measurement Science for Sustainable Construction and Manufacturing Workshop Volume I. Position Papers and Findings, University of Maryland, February 2015, pp. 182-190.

[3] U.S. Department of State Bureau of Overseas Building Operations website: http://overseasbuildings.state.gov/green_initiatives/certified_missions/

[4] World Green Building Council Rating Tools Task Group: Quality Assurance Guide for Green Building Rating Tools, Version 1.1. September 2015

[5] ISO9001:2008, page 8

[6] Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC Text with EEA relevance

[7] Directive 2012/27/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings

[8] JRC Science and Policy reports ”Green Public Procurement Criteria for the Design, Construction and Management of Office Buildings” Draft GPP Office buildings guidance document, Nicholas Dodd, Elena Garbarino, Oliver Wolf, December 2014

[9] Criteria Appendix Document BREEAM Europe Commercial for Latvia,